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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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Toshiya Uemura

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10/14/2004

MCGINN & GIBB, PLLC
8321 OLD COURTHOUSE ROAD
SUITE 200
VIENNA, VA 22182-3817

EXAMINER

BAUMEISTER, BRADLEY W

ART UNIT

PAPER NUMBER

2815

DATE MAILED: 10/14/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/819,952

Applicant(s)

UEMURA ET AL.

Examiner

B. William Baumeister

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 22 July 2004.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1,4,6,8,10,12,14,15,17,19,24,26,28,30 and 38-48 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1,4,6,8,10,12,14,15,17,19,24,26,28,30 and 38-48 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
 - ☐ Certified copies of the priority documents have been received in Application No. _____.
 - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- ☒ Notice of References Cited (PTO-892)
- ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____
- ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____
- ☐ Notice of Informal Patent Application (PTO-152)
- ☐ Other: _____

DETAILED ACTION

Claim Objections

1. Claims 44 and 48 are objected to because of the following informalities:
 - a. In claim 44, the first limitation, "a plurality of semiconductor layers comprising group III nitride...semiconductors...on said substrate;" lacks adequate antecedent basis for the recitation, "said substrate."
 - b. In claim 48, the period at the end of the sentence has been inadvertently omitted.
 - c. Appropriate correction is required.

Claim Rejections - 35 USC § 103

2. The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.
3. Claims 1, 6, 8, 12, 14, 15, 19, 24, 26, 28, 30 and 38-44 are rejected under 35 U.S.C. 103(a) as being unpatentable over Morita et al. '636 in view of JP 11-126923.
 - a. Morita discloses III-N light emitters formed on a sapphire substrate and having an emission layer 9. Morita discloses that the rear side of the sapphire substrate may further have a reflective film 11 composed of various metals such as gold (e.g., col. 5, line 14), or multilayer films of metal (e.g., col. 2, line 22). Morita further discloses that if the rear surface of the sapphire is not sufficiently smooth, a light transmissive smoothing film, which can be made of various materials such as SiO₂, can also be employed between the substrate and the reflector (col. 5, lines 18-23). Morita discusses the structure of an LED

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chip that has been singulated, and as such does not discuss the details of its intermediate structure prior to singulation.

b. JP '923 teaches GaN-based LED chips and various intermediate, pre-singulated structures. See e.g., FIGs 5-7 wherein the wafer includes split lines 21 and opposing separation grooves 22. An **aluminum reflection film 10** is formed over the rear-substrate surface including the split lines. The substrate is subsequently attached to an adhesion sheet 24.

c. It would have been obvious to one of ordinary skill in the art at the time of the invention to have provided within the Morita wafer prior to singulation, split lines and separation grooves and to have employed an adhesion sheet as taught by JP '923 for the purpose of improving the chip-dicing process as taught by JP '923.

d. Regarding the particular thickness ranges, Morita discloses all of the claimed elements other than the split lines, but does not appear to further disclose any potential thickness ranges for these layers such as the reflective layer, the light transmission layer or the substrate. Nonetheless, and regardless of whether JP '923 discloses these dimensions, it would have been obvious to one of ordinary skill in the art at the time of the invention to have formed these respective layers to thicknesses that are within the very broadly claimed ranges because thicknesses within these ranges do not produce any unexpected results and also for the purpose of optimizing their respective effects for their respective intended uses. Further, Applicant's specification acknowledges that these claimed thicknesses do not produce any unexpected results, but rather, that the limitations are based on goals that were well known in the industry: if the layers were made thinner

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they would not adequately perform their intended functions, and if made thicker they would be unduly wasteful/costly (see e.g., specification paragraphs (0057) and (0059).

i. Also, since Morita is a US Patent, and the disclosure has a presumption of validity, and therefore the invention is presumed to operate as intended, the layers would therefore necessarily at least be thicker than the claimed minimum thicknesses or they would not work as intended. With regard to the larger thickness limit, minimizing material and processing costs was a well-known industry goal at the time of the invention.

e. Regarding claim 47, JP '923 teaches that the second (rear) side of the substrate may be polished (see JPO machine translation [0005]).

f. Regarding claim 48, JP '923 further teaches that the split line 21 may have a thickness of $\frac{1}{2}$ to $\frac{5}{6}$ of the substrate thickness [0016] indicating that the opposing separation grooves 22 must have a thickness that is less than about $\frac{1}{2}$ of the substrate thickness.

4. Claims 4, 6, 10, 12, 14, 15, 17 and 19 are rejected under 35 U.S.C. 103(a) as being unpatentable over Morita '636/JP '923 as applied to the claims above, and further in view of Steigerwald GB 1899.

a. Morita discloses that various metals may be used for the substrate reflector, but does not expressly disclose that Al or Ag may be one of these metals. JP '923 teaches that aluminum may be employed as the metal reflector 10 on the rear surface of the GaN-

based LED, but does not teach that the Al may be formed on a layer that is intermediate to the sapphire substrate.

b. Steigerwald discloses III-N LEDS 16 formed on a sapphire substrate 12 with a semitransparent contact (emission) layer (see FIG 1). On the backside of the sapphire substrate is formed a mirror structure composed of a reflective layer 14 that may be composed of various metals including Al, Ag or Au of thickness with in a range including about 50 - 250 nm (see FIG 4). More strictly the specification recites that the reflective layer has a lower thickness limit of about 20 nm for Ag and Al to ensure that the reflectivity is sufficient (page 5, lines 24-28). An optional non-absorbing adhesion layer 10 may also be interposed between the reflector 14 and the substrate. Any thickness (minimum thickness of one atomic layer) may be used for the adhesion layer so long as it promotes adhesion and does not reduce reflectivity (page 6, lines 10-16). It would have been obvious to one skilled in the art at the time of the invention to have substituted either Al or Ag for the Au reflective layer of Morita because Steigerwald teaches that these metals are more highly reflective of certain III-N wavelengths and for the purpose of reducing manufacturing costs since Ag and especially Al are less expensive than gold.

Response to Arguments

4. Applicant's arguments with respect to the claims have been considered but are either moot in view of the new ground(s) of rejection or are not persuasive.

a. Applicant argues that Morita and JP '923 are not combinable because they are directed towards unrelated problems. This argument is not persuasive because, as was

explained, Morita is directed towards III-N LED chips that possess a rear-side reflector, but does not disclose how the individual LEDs were singulated from the wafer; JP '923 teaches how to form and singulate such III-N LEDs having rear-side reflectors from a common wafer. As such, the skilled artisan would have, in fact, been motivated to look to JP '923 to fill in conventional manufacturing details not disclosed in Morita.

b. Applicant argues (1) that Morita does not disclose that the light transmission layer has a thickness of at least 5 nm (as now set forth in the independent claims), and (2) that the examiner has not set forth any motivation for setting the thickness of Morita to be at least 5 nm. This argument is not persuasive because as was previously explained, this lower thickness range merely constitutes an routine optimization of design details. More specifically, since 5 nm (or 50 angstroms) is so thin so as to be on the order of several atomic layers:

- i. While not impossible, it was increasingly difficult/expensive to grow uniformly-thick layers thinner than 5 nm by the methods disclosed in Morita (e.g., CVD, sputtering, evaporation);
- ii. If Morita's substrate is so rough as to require a transparent smoothing layer, the provision of a layer so thin as to be less than several atomic layers thick would most likely not provide the intended function of smoothing the substrate's surface; and
- iii. Also, when a light transmission layer is grown to be on the order of 5 nm, such a layer's thickness starts to approach those thicknesses that are on the order of multiples of the deBroglie wavelength of the light emitted from the LED active

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layer. When this happens, depending upon whether the thickness is an even or odd multiple of the emitted light's wavelength, special light transmission and reflection phenomenon start to occur, respectively, resulting in additional design considerations not disclosed by Morita.

iv. These factors evidence that Morita's light transmission layer is either inherently at least 5 nm thick, or at least that it would have been obvious to the skilled artisan at the time of the invention to have made this layer greater than 5 nm thick.

c. Regarding the upper thickness range for the light transmission layer (e.g., claims 14-19), as was previously explained, Applicant acknowledged in the specification that the upper thickness is limited merely to reduce manufacturing costs, a goal that was well known in the semiconductor industry and every other industry as well.

d. Applicant has argued that JP '923 does not discuss the problem of volatilized gases from the adhesive reacting with the reflective metal, and as such does not render obvious a thickness range for the light transmission layer that prevents this problem. This argument is not found persuasive because, as applicant acknowledges, JP '923 teaches that the rear-side metal layer(s) can be formed on the substrate prior to attachment to the adhesive. As such, the volatility of such adhesives do not need to be taken into consideration for the combination of Morita and JP '923; the issue devolves to whether other reasons existed to set the transmission layer's thickness so as to be within the claimed ranges. Again, as was explained, it would have been obvious to minimize the thickness as much as possible to reduce manufacturing costs, while maintaining the

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thickness above a minimum level that would still allow the layer to serve its intended purpose: to provide a smooth surface. The claimed ranges (including the somewhat narrower ranges of claims 45 and 46) read on a light transmission layer of Morita whose thickness was optimized for the purposes set forth above.

e. In further response to applicant's arguments regarding the volatile adhesive, the fact that applicant has recognized another advantage which would flow naturally from following the suggestion of the prior art cannot be the basis for patentability when the differences would otherwise be obvious. See *Ex parte Obiaya*, 227 USPQ 58, 60 (Bd. Pat. App. & Inter. 1985).

f. Applicant argues that the examiner can point to no motivation or suggestion in the references to urge the combination as alleged by the Examiner. This argument is not persuasive because, as was previously explained and repeated hereinabove, Morita expressly states that other metals may be employed for the III-N rear reflector; JP '923 and Steigerwald both (1) expressly state that Al may be employed for III-N rear reflectors; and expressly set forth thickness ranges that may be employed for the Al reflector (see e.g., JP '923 [0014] setting forth an Al layer thickness of 200 nm, potentially raising the issue of whether any further reliance upon Steigerwald is even necessary).

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Conclusion

5. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than **SIX MONTHS** from the date of this final action.

Contact Information

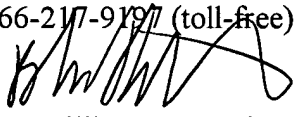
Any inquiry concerning this communication or earlier communications from the examiner should be directed to B. William Baumeister whose telephone number is (571) 272-1722. The examiner can normally be reached on M-F 8-5.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Tom Thomas can be reached on (571) 272-1664. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

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Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

BRADLEY BAUMEISTER
PRIMARY EXAMINER



B. William Baumeister
Primary Examiner
Art Unit 2815

October 13, 2004